

## TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

The distribution of the monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart II; the lines are drawn over the high irregular surface of the Rocky Mountain plateau, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

## NORMAL TEMPERATURE.

In Table II, for voluntary observers, the mean temperature is given for each station, but in Table I, for the regular stations of the Weather Bureau, both the mean temperatures and the departures from the normal are given for the current month. In the latter table the stations are grouped by geographical districts, for each of which is given the average temperature and departure from the normal; the normal for any district or station may be found by adding the departures to the current average when the latter is below the normal and by subtracting when it is above.

## MONTHLY MEAN TEMPERATURE.

For the regular stations of the Weather Bureau the monthly mean temperature is the simple mean of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

During July, 1894, the highest mean temperatures at regular Weather Bureau stations were: Yuma, 91.0; Key West, 82.4; Abilene, 82.0; Galveston, 81.3; Tucson, 85.0; El Paso, 81.0. The lowest mean temperatures were: Tatoosh Island, 54.1; Eureka, 54.4; Point Reyes Light, 52.2; Sault Ste. Marie, 64.5; Eastport, 60.6. At Canadian stations the lowest was: Father Point, 57.0. The highest was: Medicine Hat, 73.0. The temperature averaged 32 at no point within the limits of the daily map.

## DEPARTURES FROM NORMAL TEMPERATURE FOR JULY, 1894.

The following table shows for certain stations, as reported by voluntary observers, the normal and extreme mean temperatures and the departures for this month:

State and station.	(1) Normal for the month of July.	(2) Length of record.	(3) Mean for July, 1894.	(4) Departure from normal.	(5) Extreme monthly means for July.			
					Highest.	Year.	Lowest.	Year.
<i>Arizona.</i>	0	Years	0	0	0		0	
Fort Apache .....	75.6	22	72.8	- 2.8	83.6	1877	70.3	1883
Whipple Barracks .....	75.0	23	73.8	- 1.2	81.7	1878	70.4	1883, 1891
<i>Arkansas.</i>								
Keesees Ferry .....	81.0	12	76.1	- 4.9	84.2	1888	75.2	1882
<i>California.</i>								
Riverside .....	76.7	12	75.2	- 1.5	79.4	1883	73.1	1892
<i>Colorado.</i>								
Las Animas .....	75.6	11	74.8	- 0.8	79.1	1890	73.0	1891
<i>Florida.</i>								
Merritts Island .....	81.0	12	81.5	+ 0.5	83.2	1893	78.5	1886
<i>Georgia.</i>								
Forsyth .....	81.8	20	79.2	- 2.6	85.7	1881	78.3	1882
<i>Idaho.</i>								
Boise Barracks .....	73.7	20	73.8	+ 0.1	79.6	1873	69.4	1884
Fort Sherman .....	66.9	10	68.8	+ 1.9	74.2	1889	62.6	1884
<i>Indiana.</i>								
Lafayette .....	73.8	12	73.5	- 0.3	79.8	1887	69.0	1882
<i>Iowa.</i>								
Cresco .....	70.8	21	74.2	+ 3.4	75.2	1874	65.1	1891
<i>Kansas.</i>								
Eureka Ranch .....	80.7	11	78.8	- 1.9	86.2	1890	76.3	1891
Independence .....	79.5	22	80.9	+ 1.4	85.9	1879	74.7	1891
Salina .....	81.1	10	81.2	+ 0.1	86.3	1890	76.2	1891
<i>Louisiana.</i>								
Grand Coteau .....	82.1	9	78.0	- 4.1	85.4	1884	78.0	1894
<i>Maine.</i>								
Orono .....	67.0	23	67.2	+ 0.2	71.0	1887	64.2	1884

## Departures from normal temperature—Continued.

State and station.	(1) Normal for the month of July.	(2) Length of record.	(3) Mean for July, 1894.	(4) Departure from normal.	(5) Extreme monthly means for July.			
					Highest.	Year.	Lowest.	Year.
<i>Maryland.</i>	0	Years	0	0	0		0	
Cumberland .....	72.2	23	75.2	+ 3.0	77.7	1889	70.3	1888
<i>Michigan.</i>								
Kalamazoo .....	73.3	17	74.0	+ 1.7	77.8	1885	67.2	1891
<i>Missouri.</i>								
Sedalia .....	78.4	14	77.4	- 1.0	82.8	1888	71.2	1891
<i>Montana.</i>								
Fort Custer .....	70.9	12	74.5	+ 3.6	74.5	1894	67.8	1884
<i>Nebraska.</i>								
Fort Robinson .....	72.6	11	71.8	- 0.8	78.1	1886	66.9	1891
Genoa (near) .....	74.7	18	77.8	+ 3.1	78.6	1890	69.8	1891
<i>Nevada.</i>								
Carson City .....	70.9	16	66.6	- 4.3	73.7	1875	65.5	1893
<i>New Hampshire.</i>								
Hanover .....	69.1	22	69.7	+ 0.6	72.1	1878	66.3	1893
<i>New Mexico.</i>								
Fort Wingate .....	73.2	22	71.8	- 1.4	77.8	1873	68.1	1888
<i>New York.</i>								
Cooperstown .....	68.1	23	68.5	+ 0.4	73.0	1887	64.5	1884
Plattsburg Barracks .....	69.5	22	70.2	+ 0.7	73.2	1887	65.2	1891
<i>North Carolina.</i>								
Lenoir .....	74.5	21	73.7	- 0.8	77.7	1877	66.4	1884
<i>Oklahoma.</i>								
Fort Reno .....	80.7	11	80.6	- 0.1	84.9	1887	76.2	1891
Fort Sill .....	82.3	23	80.4	- 1.9	86.0	1871	77.2	1880
Fort Supply .....	80.6	15	78.3	- 2.3	85.8	1874	76.4	1891
<i>Oregon.</i>								
Bandon .....	57.6	10	57.5	- 0.1	59.5	1888	54.6	1887
<i>Pennsylvania.</i>								
Dyberry .....	67.7	21	69.4	+ 1.7	72.6	1887	63.0	1891
Grampian .....	70.5	23	72.2	+ 1.7	76.8	1887	65.4	1891
Wellaboro .....	68.7	15	70.5	+ 1.8	76.1	1881	60.4	1891
<i>South Carolina.</i>								
Statesburg .....	78.3	13	76.5	- 1.8	84.0	1881	74.6	1891
<i>South Dakota.</i>								
Fort Sully .....	74.9	23	80.7	+ 5.8	80.7	1894	70.9	1884
<i>Texas.</i>								
Austin .....	84.0	21	86.0	+ 2.0	88.3	1879, 1884	82.0	1877
Silver Falls .....	80.6	8	78.4	- 2.2	83.9	1888	74.6	1887
<i>Utah.</i>								
Terrace .....	82.1	18	80.1	- 2.0	89.3	1874	77.6	1875
<i>Vermont.</i>								
Stratford .....	69.0	21	67.1	- 1.9	73.5	1887	65.2	1893
<i>Virginia.</i>								
Dale Enterprise .....	75.6	14	74.0	- 1.6	83.0	1887	71.5	1884
<i>Washington.</i>								
Fort Townsend .....	61.2	20	61.4	+ 0.2	66.1	1875	58.3	1893
<i>West Virginia.</i>								
Parkersburg .....	77.5	13	.....	.....	87.0	1881	68.9	1886
<i>Wisconsin.</i>								
Madison .....	72.1	23	74.6	+ 2.5	75.2	1885	66.6	1891
<i>Wyoming.</i>								
Fort Washakie .....	69.2	9	67.2	- 2.0	73.7	1886	65.4	1891

As compared with the normal for July the mean temperatures for the current month were decidedly in excess in Manitoba, Assiniboia, and Alberta, the maximum being 6.6 at Qu'Appelle. The line of no departure passes from British Columbia south to central California, thence northeast to Montana, southeast to Kansas, and east to New Jersey. South and west of this line temperatures were generally below the normal, the largest deficits being 3.6 at San Francisco; 3.2 at San Diego; 3.4 at New Orleans; 3.8 at Shreveport; 3.6 at Savannah; and 4.4 at Augusta.

Considered by districts the mean temperatures for the current month show the following departures from normal temperatures:

Positive departures: New England, 1.4; middle Atlantic States, 0.4; lower Lake region, 1.0; upper Lake region, 1.7; North Dakota (extreme northwest), 2.7; upper Mississippi valley, 1.2; Missouri Valley, 0.2; northern slope, 0.7; middle plateau, 0.2; northern plateau, 0.6.

Negative departures: South Atlantic States, 2.5; Key West, 2.0; east Gulf, 2.7; west Gulf, 2.5; Ohio Valley and Tennessee, 0.8; middle slope, 1.1; southern slope (Abilene), 1.4; southern plateau, 1.4; north Pacific, 0.4; middle Pacific, 0.4; southern Pacific, 2.0.

## THE DAILY AND MONTHLY RANGES OF TEMPERATURE.

The greatest daily range of temperature is given for each of the regular Weather Bureau stations in Table I, which also gives data from which may be computed the extreme monthly ranges for each station.

*Greatest daily ranges.*—Large values: Olympia and Havre, 48; Huron, 47; Pysht, Laramie, and Williston, 46; St. Vincent and Idaho Falls, 45; Moorhead, Columbia, Mo., Bismarck, Miles City, and Columbia, Kans., 44. Small values: Eureka, 17; Point Reyes Light, 20; San Diego, 18; Galveston and Block Island, 17; Nantucket, Jupiter, Key West, and Cape Hatteras, 12; Southport and Woods Holl, 19.

*Extreme monthly ranges.*—Large values: Huron, 61; St. Vincent, 60; Sioux City, 59; Olympia and Moorhead, 56; Havre, Miles City, Marquette, and Columbia, Mo., 55. Small values: Eureka, Key West, and Hatteras, 18; San Diego and Jupiter, 20; Nantucket, 26; Point Reyes Light and Fort Canby, 24.

## DIURNAL PERIODICITY.

The regular diurnal period in temperature is shown by the hourly means given in Table V for all stations having self-registers.

## YEARS OF HIGHEST MEAN TEMPERATURE FOR JULY.

The mean temperature for July, 1894, was the highest on record at regular Weather Bureau stations, as shown in the following table, which also gives the highest previous record:

Stations.	July, 1894.		Highest previous.	
	Mean temperature.	Departure from normal.	Temperature.	Year.
Huron, S. Dak.	75.6	+3.4	74.4	1886
St. Paul, Minn.	75.8	+3.8	74.6	1874
Sault Ste. Marie, Mich.	64.5	+3.4	64.4	1892
Harrisburg, Pa.	76.0	+3.1	74.8	1893
Vineyard Haven, Mass.	73.6	+3.0	73.2	1887

## YEARS OF LOWEST MEAN TEMPERATURE FOR JULY.

The mean temperature for July, 1894, was the lowest on record at regular Weather Bureau stations, as shown in the following table:

Stations.	July, 1894.		Lowest previous.	
	Mean temperature.	Departure from normal.	Temperature.	Year.
Corpus Christi, Tex.	81.0	-1.8	81.1	1892
Galveston, Tex.	81.3	-3.3	82.1	1892
New Orleans, La.	79.2	-3.4	79.8	1886
Jupiter, Fla.	79.8	-2.5	80.3	1891
Augusta, Ga.	77.8	-4.4	77.9	1886
Charleston, S. C.	78.8	-3.5	79.1	1874
Southport, N. C.	76.8	-3.0	77.1	1892

## MAXIMUM TEMPERATURE.

The maximum temperatures of the month at regular stations of the Weather Bureau are given in Table I, from which it appears that the highest maxima were: Yuma, 113; Tucson, Fresno City, Red Bluff, Dodge City, and Omaha, 106; Pierre, 108; Yankton, 107; Fort Smith and Columbia, Mo., 105; Sacramento, Abilene, Oklahoma, Wichita, Columbia, Kans., and Des Moines, 104; Palestine, Little Rock, North Platte, Miles City, and Valentine, 103; Keokuk, Dubuque, Moorhead, and El Paso, 102; Shreveport, Topeka, and Bismarck, 101; Vicksburg, Hannibal, Davenport, La Crosse, St. Paul, Minneapolis, Sault Ste. Marie, St. Vincent, Williston, and Rapid City, 100. The lowest maxima were: Tatoosh Island, 75; Eureka, 64; Point Reyes Light, 68; Cape Hatteras, 86; Southport, 85; Nantucket, 83; Block Island, 84; Atlantic City, 87.

## YEARS OF HIGHEST MAXIMUM TEMPERATURE FOR JULY.

The maximum temperature for July was the highest on

record at regular Weather Bureau stations, as shown in the following table:

Stations.	July, 1894.		Highest previous.	
	Maximum.	Excess above previous record.	Temperature.	Year.
Corpus Christi, Tex.	98	+3	95	*
Galveston, Tex.	97	0	97	1875
New Orleans, La.	99	+3	96	*
Palestine, Tex.	103	+1	102	1887
Vicksburg, Miss.	100	0	100	*
Little Rock, Ark.	103	+2	101	1884
Memphis, Tenn.	99	0	99	*
Fort Smith, Ark.	105	+1	104	?
Wichita, Kans.	104	+2	102	1890
Columbia, Kans.	104	0	104	1892
Omaha, Neb.	106	+1	105	*
Des Moines, Iowa	104	0	104	1886
Davenport, Iowa	100	+1	99	1887
Dubuque, Iowa	102	+1	101	*
St. Paul, Minn.	100	0	100	1883
Huron, S. Dak.	108	+4	104	*
Moorhead, Minn.	102	+4	98	1890
St. Vincent, Minn.	100	+5	95	*
Marquette, Mich.	100	0	100	1878
Sault Ste. Marie, Mich.	94	+6	88	*
Alpena, Mich.	95	0	88	1886
Grand Haven, Mich.	92	+2	90	*
Rochester, N. Y.	99	+3	96	1881
Northfield, Vt.	93	+2	91	1887
Portland, Me.	97	0	97	1876

\* Frequently.

## MINIMUM TEMPERATURE.

The minimum temperatures of the month at regular stations of the Weather Bureau are given in Table I, from which it appears that the lowest minima were:

Idaho Falls, 38; St. Vincent and Olympia, 40; Sault Ste. Marie and Neah Bay, 41; Northfield, 42; Point Reyes Light, 44; Tatoosh Island, 45. The highest minima were: Yuma and Key West, 72; Jupiter, Tampa, Port Eads, and Corpus Christi, 70.

## YEARS OF LOWEST MINIMUM TEMPERATURE FOR JULY.

The minimum temperatures for July were the lowest on record at regular Weather Bureau stations as shown in the following table:

Stations.	July, 1894.		Lowest previous.	
	Minimum.	Deficit below previous record.	Temperature.	Year.
Olympia, Wash.	40	0	40	*
Detroit, Mich.	48	-1	49	1891
Cleveland, Ohio.	48	-2	50	*
Pittsburg, Pa.	49	-1	50	*
Parkersburg, W. Va.	48	-1	49	1892
Atlanta, Ga.	58	0	58	*
Augusta, Ga.	60	-2	62	*
Charleston, S. C.	64	-1	65	*
Little Rock, Ark.	60	0	60	1891
Vicksburg, Miss.	62	0	62	1894
Shreveport, La.	63	-1	64	*
Palestine, Tex.	63	0	63	1882
Abilene, Tex.	62	-2	64	*
Corpus Christi, Tex.	70	0	70	*
New Orleans, La.	67	0	67	1892

\* Frequently.

## LIMITS OF FREEZING TEMPERATURE.

The region within which the air has had a freezing temperature at some time during the month is bounded by the minimum isotherm of 32°. During July this minimum does not occur at regular Weather Bureau stations, except at the summits of Mt. Washington and Pikes Peak; its occasional occurrence at voluntary stations is shown in Table II.

## ACCUMULATED TEMPERATURES.

From January 1 to the end of the current month the average temperature for each geographical district was above or below the normal by an amount that is given in the last column of the following table. The accumulated monthly departures from normal temperatures, as given in the second column,

may be used for comparison with the departures of current conditions of vegetation from the normal conditions.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
New England .....	+ 9.1	+ 1.3	Key West .....	- 3.5	- 0.5
Middle Atlantic .....	+12.6	+ 1.8	East Gulf .....	- 0.1	0.0
South Atlantic .....	+ 5.2	+ 0.7	Southern plateau .....	-14.4	- 2.1
West Gulf .....	+ 0.6	+ 0.1	Middle plateau .....	- 9.1	- 1.3
Ohio Valley and Tennessee .....	+ 9.5	+ 1.4	Northern plateau .....	- 4.8	- 0.7
Lower Lake .....	+18.6	+ 2.7	Northern Pacific .....	- 9.8	- 1.4
Upper Lake .....	+23.3	+ 3.3	Middle Pacific .....	-13.8	- 2.0
North Dakota (Ex. N.W.) .....	+19.2	+ 2.7	Southern Pacific .....	-18.8	- 2.7
Upper Mississippi .....	+18.7	+ 2.7			
Missouri Valley .....	+13.8	+ 2.0			
Northern slope .....	+ 2.3	+ 0.3			
Middle slope .....	+ 2.8	+ 0.4			
Southern slope (Abilene) .....	+ 3.9	+ 0.6			

#### PERIODS OF HIGH TEMPERATURE.

The maximum temperatures of July generally occurred during areas of high pressure and clear, dry weather, and were evidently due to the combination of the several circumstances that conspire to bring abnormal high temperatures to any place. In general, and in the order of their importance, these favorable circumstances are as follows: (1) clear sky and maximum insolation, (2) descending currents with the consequent compression and dynamic warming, (3) favorable winds, and (4) dry, warm soil.

The combination of light winds or calms with high insolation and the radiation from a dry, hot soil is oftentimes less efficient than the dynamic warming of the strong descending winds that attend the cyclonic circulation around areas of low pressure. When these descending cyclonic winds are also the descending winds of the plains on the eastern Rocky Mountain slope, we have the special hot winds that occur in the summer time from Texas to the Dakotas. This combination was explained by the editor in 1890 (see *WEATHER REVIEW*, Feb., 1894, p. 77), and has been elaborately defended in a memoir by Dr. I. M. Cline (*Am. Met. Journ.*, Sept., 1894, p. 175, and *Bull. Phil. Soc.*, Wash., 1894, xii, p. 335). The principal hot periods of the current month were as follows:

(A) 1st, the maximum temperatures of the month occurred in Louisiana, Arkansas, southern Missouri, and on the 2d this area had extended eastward to Kentucky, Tennessee, and Alabama, and westward to Texas and Oklahoma; on the 3d, it extended westward over central Texas, and on the 4th, reached northern Mexico and El Paso on the west, and Georgia on the east. During the 5th and 6th, South Carolina, and on the 7th, southern South Carolina and the peninsula of Florida had the highest temperatures of the month.

(B) On the 10th the highest temperatures of the month were experienced in northern Nevada, Utah, western Colorado, Wyoming, and western South Dakota. This warm region advanced eastward, covering South Dakota and Minnesota on the 11th, Wisconsin on the 12th, Virginia on the 13th, and the interior of North and South Carolina and southern New Jersey on the 14th.

(C) From the 13th to the 20th the high pressure stretching from British Columbia to Florida gave frequent occasion for southerly winds and high temperatures on the northern border of our Weather Map, and the maximum temperatures of the month occurred during this week in western Oregon, 12th, 13th, 14th; at St. Vincent, 16th; in southern Michigan, Ohio, western Pennsylvania, and New York, 17th to 20th.

(D) From the 21st to the 25th, areas of low pressure were developing and moving slowly eastward from British Columbia. On the southern side of this region areas of high pressure prevailed, bringing the highest temperatures of the month, on the 23d, in western Oregon, Washington, Idaho, and western Montana; from the 24th to the 26th, in eastern Montana,

Nebraska, Colorado, Kansas, Missouri, Iowa, Illinois, Wisconsin, and upper Michigan. The maximum temperature at these stations ranged from 100° on the 25th and 26th with wind as high as 35 to 50 miles per hour. Owing to the great evaporation caused by these hot, dry winds, vegetation suffered severely. The area of low pressure, No. XII, was central on the 26th, p. m., in central South Dakota, and the 27th, p. m., in the southeastern corner of South Dakota. The intensely hot, dry, southerly winds were south and east of this center and corresponded to still more rapid southwest winds in the upper regions of the atmosphere, and must, therefore, have, within the preceding twenty-four hours, descended into the lower parts of this cyclone from above the Cordilleras and plateau of Mexico. As very little rainfall or cloud could occur, the low pressure rapidly filled up and disappeared after the 27th.

(E) The influence of the causes producing these hot winds was felt slightly in Ohio on the 27th, and in the middle Atlantic States and New England on the 28th and 29th, when the maximum temperatures of the month generally occurred. But in these regions the high temperatures were generally between 95° and 100°, and the winds rarely above 20 miles, and much more cloud, with occasional light rain, occurred. On these days the principal flow of air in the regions above these States seems to have been the outflow from the tropical area of high pressure over the Atlantic which was at that time impinging on the south Atlantic coast.

#### AREAS OF 20° RISE IN TWENTY-FOUR HOURS.

The daily weather charts show by heavy dotted lines the regions over which the temperature has risen 20° in the preceding twenty-four hours. The occurrence of such rapid rises becomes less frequent as we approach the midsummer season, and no such areas appear on the maps for the current month; but numerous cases occurred where this limit was very nearly attained.

#### PERIODS OF LOW TEMPERATURE.

The minimum temperatures occurred principally during the first half of the month and may be arranged in the following groups:

(A) On the 1st in eastern Oregon, Montana, and South Dakota. This region of low temperature spread eastward, covering Iowa, Wisconsin, southern Michigan, and Indiana on the 7th; Ohio, Kentucky, Tennessee, and West Virginia on the 8th; the lower Lakes, Pennsylvania, New York, and southern New England on the 9th; the middle Atlantic States, North and South Carolina, and Georgia on the 10th and 11th; it also extended southwestward over southern Missouri, Kansas, and Arkansas on the 9th; and Mississippi, Louisiana, and Texas on the 10th.

(B) In Nebraska the lowest temperatures of the month generally occurred on the 20th, and this minimum moved southward into Colorado and Kansas on the 21st and eastward into Missouri and Illinois on the 22d; it reached Cairo and Meridian on the 24th.

In general these minimum temperatures represent the combined effect of local radiation and the very slow descent of cold air on clear nights in the midst of the areas of high pressure.

As a rule the regions of maximum fall in temperature during the night, or of maximum fall in twenty-four hours, is in advance of the region of maximum rise of the barometer in twenty-four hours and thus indicates the direction in which the atmosphere is flowing outward from the area of high pressure.

#### AREAS OF 20° FALL IN TWENTY-FOUR HOURS.

A fall of temperature of 20°, or more, in twenty-four hours is not called a cold wave by the Weather Bureau unless the tem-

perature falls below 40°, and is, therefore, likely to cause a frost injurious to vegetation, but all falls of 20° are indicated on the Daily Weather Map by inclosing the areas within which they occur by heavy dotted lines, and the following list enumerates these regions for the month of July (the dimensions of the principal axes of the areas are stated in miles):

(A) 20th, a. m., 200 by 300 over Lake Superior. This fall represented the front of a mass of cool air flowing southward in connection with high area No. IV. 20th, p. m., 100 by 200, southeastern Michigan. This fall was due largely to the change from bright sunshine on the 19th to rain on the 20th, accompanied by the cold, northerly winds of high No. IV. This cold area does not appear on the map of the 21st, a. m., although falls of 18° occurred at Montreal and Buffalo, but it reappeared on the map of the 21st, p. m., when falls of 20° occurred at Boston and Albany and 18° at Portland, Me., representing an area of about 150 by 250. The relations of the so-called local storms to the general movements of the atmosphere were elucidated by Marie-Davy in 1864 and E. Fron in 1867; in 1871 the present editor showed that a very important class of our local rains and thunderstorms occurs at the front of advancing waves of cool, dry air, and may, therefore, be described as located on the south and east sides of areas of high pressure. When the winds develop into a cyclonic system the local storms are carried around to the

south and east sides of the cyclonic center and are most frequent in the area of southerly surface winds.

(B) The map of the 25th, 8 p. m., shows a fall of 20° at Chicago, 26° at Duluth, and 18° at Port Arthur, but these three falls are apparently local matters due to the change from hot land breezes to cold lake breezes. On the other hand the stations in Montana, Assiniboia, and Alberta also show falls of 20° or more, evidently due to the inflow of cool air in the rear of low No. XII and in advance of high No. V; an area of 300 by 400 is covered by this fall. 26th, p. m., 200 by 150 in the western part of North Dakota. 27th, p. m., 100 by 100, South Dakota and Nebraska. 28th, p. m., 100 by 100, Upper Michigan. These successive areas of 20° fall are apparently all due to the change of wind and temperature immediately following in the rear of low No. XII.

(C) 30th, 8 p. m., 300 by 200, Wisconsin and Minnesota. This represents the front of an area of high pressure descending southward in connection with low No. XIII, but the heaviest fall, 26°, at Duluth, was largely due to the change from land breeze to lake breeze.

#### FROSTS.

Notwithstanding the high temperature of July a few reports of frosts have been received, viz, 9th, light at Garrettsville and Lordstown, Ohio; Cassandra, Lock Haven, Saegers-town, Kane, and Somerset, Pa.

### PRECIPITATION.

[In inches and hundredths.]

The distribution of precipitation for the month of July, 1894, as determined by reports from about 2,000 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III; the first of these also gives the average departures from the normal for each district, whereas the average departure for each State is given in the chapter on State Weather Services.

#### NORMAL PRECIPITATION FOR JULY.

The normal precipitation for the month of July is usually greatest on the east Gulf and west Florida coasts. From 4 to 6 inches usually falls in the Mississippi Valley and westward to the Rocky Mountain slope. Less than 1 inch is to be expected in Oregon and the plateau region, and little or none in California.

#### PRECIPITATION FOR CURRENT MONTH.

The total precipitation for the current July was heaviest in southeastern Georgia and South Carolina, where it ranged between 10 and 15 inches. From this region outward it diminished to about 2 inches at Key West, 6 inches at Galveston and Norfolk, and in northern Georgia, northern Mississippi, and western North Carolina; 1 inch or more fell in the region southeast of central Michigan, central Illinois, northern Missouri, eastern Oklahoma, and central Texas. The average rainfall for Iowa, Wisconsin, Minnesota, and the eastern portion of Kansas, Nebraska, North and South Dakota was about one-half inch, constituting the beginning of a severe drought and stimulating useless efforts at rain-making in various parts of these States. The operations on the 14th, 15th, 16th, and 26th to 31st, by several persons in different places, do not seem to have given those localities any more rain than happened in their neighborhood.

#### CURRENT DEPARTURES FROM NORMAL PRECIPITATION.

The precipitation for July was in excess over the greater part of the Gulf and south Atlantic States, but decidedly deficient in the Middle and Eastern States, Ohio Valley, the Lake region, and Missouri and upper Mississippi valleys.

The principal departures from the normal were:

Excesses: New Orleans, 5.1; Augusta, 5.8; Savannah, 8.1. Deficits: Dubuque, 4.9; Omaha, 4.7; Lexington, 4.3; Keokuk, 3.9; Philadelphia, 3.8; Pittsburg and Huron, 3.7; Indianapolis, 3.5; Davenport, 3.4; Halifax, Chicago, and St. Paul, 3.2.

The following table shows for certain stations, as reported by voluntary observers, the normals and extremes of total precipitation for this month and the current departures:

State and station.	(1) Average for the month of July.	(2) Length of record.	(3) Total for July, 1894.	(4) Departure from average.	(5) Extremes for July.			
					Greatest.		Least.	
					Amt.	Year.	Amt.	Year.
<i>Arizona.</i>	<i>Inches.</i>	<i>Years</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	
Fort Apache .....	3.75	18	1.27	- 2.48	8.76	1878	0.14	1884
Whipple Barracks .....	2.89	23	1.13	- 1.76	5.92	1875	0.55	1877
<i>Arkansas.</i>								
Keesees Ferry .....	4.74	12	10.52	+ 5.78	11.60	1883	1.15	1888
<i>California.</i>								
Riverside .....	T.	13	0.00	- T.	0.02	1888	0.00	*
<i>Colorado.</i>								
Las Animas .....	1.67	11	0.10	- 1.57	4.66	1886	0.10	1894
<i>Florida.</i>								
Merritts Island .....	5.88	16	3.87	- 2.01	11.72	1884	0.86	1883
<i>Georgia.</i>								
Forsyth .....	4.77	20	5.91	+ 1.14	12.70	1887	0.32	1878
<i>Idaho.</i>								
Boise Barracks .....	0.17	20	0.00	- 0.17	0.60	1884	0.00	†
Fort Sherman .....	0.51	10	T.	- 0.51	1.67	1884	0.00	1882, 1883
<i>Indiana.</i>								
Lafayette .....	3.53	12	1.55	- 1.98	5.81	1884	0.88	1887
<i>Iowa.</i>								
Cresco .....	4.24	21	0.09	- 4.15	12.70	1883	0.09	1894
<i>Kansas.</i>								
Independence .....	4.15	22	2.36	- 1.79	11.56	1875	0.77	1888
Salina .....	4.17	10	0.33	- 3.84	7.20	1885	0.30	1890
<i>Louisiana.</i>								
Grand Coteau .....	5.76	10	6.54	+ 0.78	12.36	1889	1.89	1888
<i>Maine.</i>								
Orono .....	3.40	23	2.41	- 0.99	7.11	1887	1.05	1886
<i>Maryland.</i>								
Cumberland .....	3.41	22	3.23	- 0.18	5.59	1887	1.01	1885
<i>Michigan.</i>								
Kalamazoo .....	3.38	18	1.34	- 2.04	6.50	1877	0.79	1887
<i>Missouri.</i>								
Sedalia .....	4.35	16	2.81	- 1.54	10.21	1893	0.62	1886
<i>Montana.</i>								
Fort Custer .....	1.03	13	1.75	+ 0.72	2.51	1880	0.06	1890